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March 21, 2009

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To Whom It May Concern:

It is a great pleasure to write this letter of support for the Visualization and Analytics Center for Enabling Technology (VACET) which has positively impacted our science productivity by enabling us to glean physical insight from terabytes of combustion simulation data.

I am writing as the lead PI of several DOE INCITE awards and as the PI of both a DOE Basic Energy Sciences Chemical Physics project on turbulent reactive flows and a DOE ASCR project on data discovery. In this role, I am leading a team of researchers responsible for the development of advanced computational methods aimed at the Direct Numerical Simulation of the full three-dimensional dynamics of turbulent flames undergoing strong finite-rate chemical processes, including local extinction and autoignition. These simulations are the first-ever 3D direct numerical simulations of fully developed turbulent flames with detailed chemical kinetics, providing a wealth of data for both fundamental understanding and model validation.

During our collaboration, VACET researchers have been collaborating closely with us to develop new advanced topological methods for the robust characterization and segmentation of extinction and reigniting regions that are generated intermittently during combustion. In a second related project VACET researchers are helping us understand the role of transient autoignition in the stabilization of lifted turbulent jet flames by exploring the use of Jacobi sets together with in-situ particle tracking in the time tracking of shortlived, small spatial ignition features. These methods have enabled us, for the first time, to robustly track over time large numbers of extinction or ignition regions, which is essential to the development of a better understanding of the flame extinction/reignition and stabilization dynamics. Better understanding of the details of such flames enable new insights into reducing pollutants and increasing efficiency in combustion devices. This research could have long-term applications in such areas as jet aircraft engines, where fuel and oxidizers are not premixed for safety reasons, and in direct-injection internal combustion engines where diesel jet flames are stabilized downstream of the fuel injector in a hot ignitive coflow.

Overall, our collaboration with the VACET team has proven to be extremely valuable and is accelerating our progress towards the understanding of combustion science from 100's of terabytes of complex, multi-scale data generated from scientific simulations. We are planning to expand our collaborative efforts with the VACET team in the coming year, and we expect that

the innovative data analysis techniques developed in the process will be extremely valuable, not only for us, but for a wide range of scientific applications.

Sincerely yours,

Jacqueline H. Chen
Distinguished Member of Technical Staff
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